Analysis of Hand Based Interactions in Augmented Reality

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Abstract - Augmented Reality(AR) is becoming an integral part of today's technology. Normally people use Virtual Reality based systems to immerse themselves into a virtual world. But using AR we integrate computer generated imagery into the real world scene. Many techniques are used to implement different AR systems in different kinds of applications.

AR could eventually be used in assisting in day to day activities. To create a symbiotic relation between AR and humans, we need a system to make interactions as seamless and natural as possible. The most straightforward yet complex system to do so is Hand Based Interactions(HBI). By analyzing existing HBI system we can incorporate a more robust and accurate system to understand human input.

Key Words: Augmented Reality, Computer Vision, Hand-based Gestures.

1. INTRODUCTION

Many prototypes implemented using sophisticated computer vision algorithms can reliably recognize gestures, which shows that gesture recognition is possible, but quite complex. When the hand is in front, the accuracy of the posture estimate reaches a very high value, but recognizing hand gestures when the whole hand is not in view is very difficult with only computer vision.

Hand based interactions in Augmented Reality can have various applications, such as the possibility of interaction by connecting two fingers allows a realistic manipulation of virtual content. The use of augmented reality will enable users to use gestures to perform certain actions of the application. We can display a virtual menu and capture the feed of the user in real time on the screen for selection operations. Users can directly point to button / operation for dynamic input. The user can also point with bare hands or with gloves or any other object. There are no restrictions on the background of the live feed.

Therefore, the upgrade to hand based gestures in Augmented Reality (AR) has the advantage of high efficiency and input bandwidth between Human Computer Interaction(HCI).

2. AUGMENTED REALITY

Augmented reality (AR) is an enhanced version of the real world that can be achieved through the use of digital visuals, sounds, or other sensory input provided through technology.

This is a growing trend among companies involved in mobile computing and business applications.

In the boom of data collection and analysis, one of the main goals of augmented reality is to highlight specific features of the physical world, improve understanding of these features, and draw conclusions.

Augmented reality (AR) involves overlaying visual, auditory, or other sensory information onto the world to enhance the user experience. It is an experience where designers enhance parts of users' physical world with computer-generated input. Retailers and other companies can use augmented reality to promote products or services, launch novel marketing campaigns, and attract unique users. Unlike virtual reality that creates its own network environment, augmented reality adds to the existing world as it is.

3. HAND BASED INTERACTIONS

Hand Based recognition is a perceptual computing user interface that enables computers to capture and interpret human gestures as commands. Simply put, the ability of a computer to understand gestures and execute commands based on these gestures is called gesture recognition.

In the most general sense, the term "gesture" can refer to any non-verbal communication designed to convey specific information.

In the field of gesture recognition or hand based interactions, a gesture is defined as any large or small body movement that can be interpreted by a motion sensor. It can include anything from pointing a finger, to swiping in the air, or pinching and panning.

To recognise an interaction using camera, we generally use the following process:

1. A live feed captures and detects the hand
2. A library is generated which identifies meaningful gestures from a set of predetermined gestures
3. A live feed is correlated against each registered real-time gesture, and the gesture is interpreted.

The physical world and virtual augmentation. In order to have human interaction with an augmented environment, human gestures must be recognized. The hand and gesture recognition process begins by detecting the largest finger blob. The finger tip location is calculated for the pointing action and finger blob count is used for the select action. The fundamental interaction parameters are the gesture type and the location of interest.

The system detects hand-based selection with location of interest accurate enough to manipulate common window controls. This provides users with an effective tool for system property manipulation in an Augmented Reality Environment.

4. LITERATURE REVIEW

4.1 Direct hand touchable interactions in augmented reality environments for natural and intuitive user experiences

In this paper, researchers thought about how users can naturally communicate with AR scenes and provide information efficiently in various AR environments, mainly focus on presenting the recorded information in the real world and don't care much about how users interact with this system. The relationship with pure virtual information becomes very complex.

The attempt to provide an intuitive and natural AR interaction is to integrate the physical world through a tangible interface. The interface type supports direct interaction with the real world using real physical objects and tools. So tangible AR combines the intuition of a realistic interface with realistic AR rendering capabilities. We typically rely heavily on our hands to interact with physical objects in the physical world, so we most need to support direct hand interactions and behaviors in AR-based user experiences. AR's intuitive and natural interactions with virtual objects in various AR user environments have evolved rapidly, but there are limitations and disadvantages in providing natural nuance, fuzziness, and control. Therefore, further research is needed.

To provide a more natural interaction and improve the efficiency of the user experience, an AR interface that can be touched by hand is implemented. It was found that direct-touch AR interaction increased realism, accuracy, and ease of interaction over other approaches, but there is still room for improvement in future research.

4.2 Hand-based interaction in augmented reality

Unlike virtual reality, which encompases a user in a computer generated environment, in AR user sees both

A major design goal of augmented reality systems is real time frame capture and augmentation. The augmentation improvements provided by hand detection process increased immersion significantly. In-accuracies in the visual occlusion of objects drastically hinders the users presence with the virtual objects. Also the instability of virtual objects immediately separates them from the real environment. Increasing the robustness of the corner tracking technology reduced the positional variance significantly.

4.3 Interacting with Hand Gestures in Augmented Reality: a Typing Study

In this paper, researchers suggest that people often ignore cell phones and don't provide much information about their surroundings. This is dangerous for them and those around them. Research shows that using a smartphone can cause neck pain, and some people have expressed concern about chronic neck pain. These problems can be alleviated or eliminated by wearing augmented reality glasses. Augmented reality glasses can display virtual objects without affecting the real environment or compromising user perception. Wearing augmented reality glasses has a greater visual impact on the environment, so users do not need to bend over. This can improve conditions that do not cause neck pain. In this article, you can use augmented reality glasses such as a smartphone with augmented reality. We decided to test if gestures are an easy way to write augmented reality text. This decision was made because many smartphone-related tasks, such as sending emails, require text entry. So, the results may be more common in the real world. Gestures are chosen to convey the actual whole conversation. Control experiments were conducted to compare text input due to hand movement and interaction of touch screen input.

The camera technology uses a camera to record the movements of the hands and fingers. One of the two most popular methods is to use infrared (IR) light to measure the distance between your hand and finger and between CML and Kinect. On the other hand, you can also use the camera to track objects based on color. Anse and others use skin color to separate their hands from the background. Both Lipp and Microsoft have motion detection products on the market. Leap Motion includes LMC, and Microsoft has several versions of Kinect. The LMC is a handheld camera based detector that emits 3 infrared LEDs and collects the reflected infrared rays from 2 cameras.

This data is analyzed using complex mathematics to record hands and steps. The first generation Kinect includes infrared imaging devices that make up multiple infrared devices, and infrared cameras that capture infrared images. I know the pattern of the pipe, but it is

relatively random. 3D points can be reconstructed by aligning the points with images of known point patterns. The second-generation Kinect emits infrared rays and measures the reflection time of the light. If you know the time and speed of light, you can calculate the distance to an object in this scenario. The goal is to provide an option similar to a smartphone's touchscreen by recognizing hand gestures in augmented reality, allowing users to point directly at the screen and use input gestures in various program actions.

4.4 Study of Gesture Recognition methods and augmented reality

Hand Gesture modelling is primarily required for motion restoration and provides a new approach to machine access . In modeling, the two common methods are called spatial and temporal methods. These methods are used in a variety of situations where the size of the factor is important, but is temporarily used when considering hand movement . Manual modeling is important for 2D and 3D space execution .

Various hand modeling methods that represent hand posture. (A) 3D volume model. (B) 3 geometric models. (C) 3D skeleton model. (D) Model based on color marking. (E) Non-geometric model (binary contour). (F) 2D deformed template model. Movement-based model.

Using augmented reality, gestures will be detected to perform certain actions of the application

It proposes a system that can be processed using augmented reality technology. This also focuses on a more user-friendly interface between the user and the computer. Users can use augmented reality to control any recent application. The user can point directly at the screen and enter gestures to control various functions of the media player. Augmented reality technology is more accurate. Improved technology is arguably the most promising human-computer interaction technology. In the near future, there is also great potential for greater efficiency in the e-commerce system.

4.5. Summary of Literature Review

Title of Paper	Techniques Used	Drawbacks
Direct hand touchable interactions in augmented reality environments for natural and intuitive user experiences	The hand touchable AR interface implemented is based on the combination of a markerless AR and an effective hand touch recognition using a depth camera.	There was some mismatch between the AR scene and the physical scene when the size of the view is changed so that it was not easy to accurately select menus or buttons with a hand gesture.
Hand-based interaction in augmented reality	Image subtraction using homography	Inaccuracies in the visual occlusion of objects drastically hinder the user's presence with the virtual objects
Interacting with Hand Gestures in Augmented Reality: a Typing Study	Two Hand Gesturing Keyboards used (One touch screen keyboard and One Using Hand Gestures)	The results suggest that hand gestures in an AR HMD are less practical than using a smartphone touchscreen for typing text
Study of Gesture Recognition methods and augmented reality	To achieve Gesture Recognition, techniques like 1.Blurring Image 2.RGB to HSV 3.Thresholding 4.Blob Detection is used	No apparent drawback.

5. CONCLUSIONS

The upgrade to hand based gestures in Augmented Reality (AR) has the advantage of high efficiency and input bandwidth between Human Computer Interaction(HCI).

Although gesture-based interaction technology has been used in many fields, such as robot control, navigation systems, medical research, etc., it has not yet been fully integrated into our daily lives. It provides a simple, usable and interesting user interface and meets users' needs for greater freedom.

Reviewing the development of gesture-based interactive technology, there will be enormous potential for alternative input control like Hand-based interactions in the future. We can conclude that gesture-based interaction will be a complement to traditional interaction, not a future replacement.

The Recent innovations have streamlined gesture recognition and hand based interactions for Augmented Reality, although this warrants further research to create these interactions more reliable and accurate and faster to compute in real time.

6. REFERENCES

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